DOCUMENT RESUME

ED 116 035 CE 005 951

AUTHOR	Carpenter, James B.; And Others
TITLE	Comparative Analysis of the Relative Validity for Subjective Time Rating Scales. Final Report.
INSTITUTION	Air Force Human Resources Lab., Lackland AFB, Tex. Occupational and Manpower Research Div.
SPONS AGENCY	Air Force Human Resources Lab., Brooks AFB, Texas.
REPORT NO	AFHRL-TR-75-63
PUB DATE	Dec 75
NOTE	50p.
EDRS PRICE	MF-$0.76 HC-$1.95 Plus Postage
DESCRIPTORS	*Analysis of Variance; Comparative Analysis; *Job Analysis; Military Personnel; Military Training; Occupational Information; *Predictive Validity; *Rating Scales; Task Analysis; Test Reliability; Test Validity; *Time
IDENTIFIERS	Air Force; CRICOM; Criterion Comparison Values

ABSTRACT

Since the accuracy and validity of occupational data may vary according to the rating scale format employed, the first phase of the research described in the report employed hypothetical job descriptions from which accurate criterion data could be generated. The second phase of the research required developing an occupational survey instrument specifically designed for Air Force basic trainees. Criterion comparison (CRICOM) or error values were used with an analysis of variance design to determine the relative validities for subjective time rating scales. It was found that five-point relative scales were inferior to the other scales tested and that job incumbents could use scales of greater complexity than had previously been indicated in the literature. Results of the investigation indicate that a nine-point relative time spent scale yield the most accurate job description data from job incumbents using the Air Force developed occupational analysis methodology. Four appendixes covering 35 pages provide hypothetical job descriptions, time spent scales, and basic trainee job-task inventory.
(Author/JR)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

AFHRL-TR-75-63

AIR FORCE

HUMAN RESOURCES

LABORATORY

ED116055

CE005951

COMPARATIVE ANALYSIS OF THE RELATIVE VALIDITY FOR SUBJECTIVE TIME RATING SCALES

By

James B. Carpenter, Col, USAF
M. Joyce Giorgia
Barry P. McFarland, Capt, USAF

OCCUPATIONAL AND MANPOWER RESEARCH DIVISION
Lackland Air Force Base, Texas 78236

December 1975

Approved for publice release; distribution unlimited.

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235

NOTICE

When US Government drawings, specifications, or other data are used for any purpose other than a definitely related Government procurement operation, the Government thereby incurs no responsibility nor any obligation whatsoever, and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise, as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

This final report was submitted by Occupational and Manpower Research Division, Air Force Human Resources Laboratory, Lackland Air Force Base, Texas 78236, under project 7734, with Hq Air Force Human Resources Laboratory (AFSC), Brooks Air Force Base, Texas 78235.

This report has been reviewed and cleared for open publication and/or public release by the appropriate Office of Information (OI) in accordance with AFR 190-17 and DoDD 5230.9. There is no objection to unlimited distribution of this report to the public at large, or by DDC to the National Technical Information Service (NTIS).

This technical report has been reviewed and is approved.

RAYMOND E. CHRISTAL, Chief/R&D Director
Occupational and Manpower Research Division

Approved for publication.

HAROLD E. FISCHER, Colonel, USAF
Commander

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFHRL-TR-75-63	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) COMPARATIVE ANALYSIS OF THE RELATIVE VALIDITY FOR SUBJECTIVE TIME RATING SCALES		5. TYPE OF REPORT & PERIOD COVERED Final 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) James B. Carpenter M. Joyce Giorgia Barry P. McFarland		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Occuaptional and Manpower Research Division Air Force Human Resources Laboratory Lackland Air Force Base, Texas 78236		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62703F 77340113
11. CONTROLLING OFFICE NAME AND ADDRESS Hq Air Force Human Resources Laboratory (AFSC) Brooks Air Force Base, Texas 78235		12. REPORT DATE December 1975 13. NUMBER OF PAGES 52
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

job analysis
occupational data
rating scales
time spent scales
Comprehensive Occupational Data Analysis Program (CODAP)
criterion comparison (CRICOM) values
analysis of variance
simple main effects
Newman-Kuels test

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report summarizes the results of two separate investigations aimed at determining the inherent accuracy of derived job descriptions. Since the accuracy and validity of occupational data may be differentially affected by the rating scale format employed in gathering the data, the first phase of the research reported incorporates hypothetical job descriptions from which accurate criterion data could be generated. The second phase of the research necessitated the development of an occupational survey instrument specifically designed for Air Force basic trainees. Actual time spent measures supplied by supervisors was found to have sufficient reliability for use as a criterion in this phase of the investigation. Criterion comparison (CRICOM) or error values were used with an analysis of variance design to determine the relative validities for subjective time rating scales. In general, five-point

(OVER)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Item 20 (Continued)

relative scales were found to be inferior to the other scales used in this study. It was further established that job incumbents can use scales of greater complexity (e.g., a wider range of response options) than had previously been indicated in the literature. The discrepancies in estimates of absolute time or percentage values previously reported were confirmed, but the inaccuracies within this approach were found to relate only to the absolute raw values. When these absolute values were treated as relative indices, no significant differences in the validity of the derived job descriptions were universally obtained. Results of this investigation were interpreted to indicate that a 9-point relative time spent scale represents an optimal solution to the interactive problems of complexity and efficiency with regards to obtaining viable job description data from job incumbents using the Air Force developed occupational analysis methodology.

TABLE OF CONTENTS

		Page
I.	Introduction	3
II.	Background	3
III.	Experimental Design	4
	Research Employing Hypothetical Job Descriptions	4
	Research Employing a Job Task Inventory	7
IV.	Discussions and Conclusions	11
	References	13
	Appendix A: Hypothetical Job Descriptions	15
	Appendix B: Time Spent Scales	21
	Appendix C: Basic Trainee Job-Task Inventory	27
	Appendix D: Time Spent Scales	41

LIST OF TABLES

Table		Page
1	Data Analyses of CRICOM Values	6
2	Data Analyses Using Squared CRICOM Values	8
3	Analysis of Variance Individuals vs the Total Group	10
4	Analysis of Variance Individuals vs Their Squadron	11

COMPARATIVE ANALYSIS OF THE RELATIVE VALIDITY FOR SUBJECTIVE TIME RATING SCALES

I. INTRODUCTION

The ability to accurately define the composition and content of existing jobs in the United States Air Force is a vital prerequisite to the effective operation of the Air Force personnel management system. Such job analysis information serves as the basis for modification of the existing classification structure and personnel selection techniques, measurement of job difficulty and incumbent performance, and forms the necessary input for the determination of appropriate job reengineering actions. Additionally, when used as the basis for determining job training requirements, this type of information has resulted in large savings to the Air Force through elimination of training on tasks no longer generally performed and identification of those areas of training which could be more effectively presented "downstream" in an airman's career. The essential rationale and research evidence upon which the existing Air Force method of job analysis is based has been comprehensively reported by Morsh, Madden, and Christal (1961). Archer and Fruchter (1963) have described procedures for constructing and reviewing job analysis inventories Morsh and Archer (1967) set forth detailed procedures for collecting, organizing, analyzing, and reporting information describing Air Force jobs.

The Air Force occupational analysis program, designed specifically for large scale administration and operational application, requires job incumbents to specify, using relative time-spent ratings, each task performed in their job. Using a task level survey instrument, each incumbent identifies those tasks which are part of his job and indicates the relative time spent on each task performed as compared to all other tasks which he performs. This data, once collected, is then analyzed using the Comprehensive Occupational Data Analysis Programs (CODAP) in which a variety of outputs allow the job analyst to derive, describe, and evaluate existing jobs within United States Air Force career specialties (AFSC).

Initially, using the INPSTD (Input Standard) program (Christal, 1972), the relative time-spent ratings provided by the job incumbent are summated and the rating for each task performed is divided by the summated total of all ratings. Assuming all tasks performed are included in the inventory, either an individual or a group job description which specifies the percent time spent on each task performed and portrays an accurate description at the task level of the actual job as it exists can be easily generated. In addition to individual and group job descriptions, individual and group job difference descriptions form an essential part of the formalized job analysis program which includes a hierarchical grouping technique especially developed for use with occupational data (Christal, 1963; Christal & Ward, 1967; Ward, 1963). This automated procedure allows the analyst to identify specific types of jobs as they exist within the general specialty. In this application of CODAP, grouping is based on the degree of overlap in derived percent-time spent on each task as reported by the job incumbent. Archer (1966) has clearly explained the technique using miniature samples and provided examples of the resulting group job descriptions.

The CODAP programs, since their inception in the mid-1960s have been continuously reviewed and refined until today they serve as the basic analytical technique for presenting a job analyst with valid and readily interpretable information on the content of Air Force jobs and specialties. However, these programs obviously assume and require accurate input data. To the extent that a job incumbent is unable to provide information easily reducible to accurate percent-time spent values for each task performed, errors may occur in the resulting groups and job descriptions. It is the purpose of the research reported herein to investigate both the magnitude of existing errors and possible methods of reducing any errors caused by the time spent scale employed and the incumbent's associated inability to use that scale to provide accurate time spent values.

II. BACKGROUND

Prior research has shown a relative time-spent scale format to be highly reliable in obtaining consistent self reports of the time spent on the varied tasks comprising a worker's job. Additionally, nonquantifiable analyses of the accuracy of the derived job descriptions have supported the use of this type of scale format as an effective solution to many inherent problems in obtaining valid occupational data.

However, while previous research (Carpenter, 1974) has shown group job descriptions when comprised of more than five individuals to be both stable and valid, the need for an empirical quantification of the accuracy of an individual job description, prior to its use in job reengineering, organizational restructuring, and the development of assignment projection models remains. An effective solution to this problem suggests an immediate need to minimize any error in derived job descriptions which may be influenced by or result from the scale format employed in obtaining occupational data.

The historical problem with this direct approach has been the establishment of accurate criterion information for use in quantifying any existing errors in the job description. In an effort to circumvent this problem and investigate specifically the effect of varied potentially useable scale formats on the accuracy of the derived job description, it was hypothesized that specified actual time spent in performing the varied tasks comprising a hypothetical job would provide an adequate stimulus for use in evaluating the accuracy of a derived job description. Two specific approaches to an investigation of this topic were designed and the results of these research investigations and associated findings are reported.

III. EXPERIMENTAL DESIGN

Research Employing Hypothetical Job Descriptions

Two hundred and sixty-five airmen, who were in their fifth week of Air Force basic military training, served as the subjects in the first phase of this research. These subjects were randomly assigned to one of five experimental groups, each comprised of 53 personnel. The experimental materials consisted of five hypothetical job descriptions which included a specification of the tasks performed and the average time per week spent on each task. Subjects were asked to evaluate one job and, assuming the description to be an accurate representation of a job, attempt to use each of five different rating scales to describe this job. Each of the hypothetical job descriptions consisted of an identical task listing broken down into five major duty headings and identified certain tasks as being performed together with the actual average time in minutes per week spent on each task performed. The duty-task listing and time-spent values for each of the five job types employed within this study are provided in Appendix A and briefly summarized in the following paragraphs.

Job Type 1. This job consists of eight tasks with an average time-spent per task of 300 minutes per week. The ratio of least to greatest time spent on any one task is 1 to 26 and the distribution of times is negatively skewed. The job described encompasses tasks which would be performed by an Auto Engine/Mechanical Repairman.

Job Type 2. This job consists of twelve tasks with an average time-spent per task of 200 minutes per week. The ratio of least to greatest time spent on any one task is 1 to 18 and the distribution of times is positively skewed. This job encompasses tasks which might be performed by an Auto Body Repairshop Foreman.

Job Type 3. This job consists of twelve tasks, which are normally distributed around the mean of 200 minutes per week per task. The ratio of least to greatest time spent on any one task is 1 to 7. This job encompasses tasks which would be performed by an Auto Repair Shop Service Manager.

Job Type 4. This job consists of sixteen tasks with an average time-spent per task of 150 minutes per week. The ratio of least to greatest time spent on any one task is 1 to 5. The job described is that of a General Auto Mechanic.

Job Type 5. This job consists of twenty tasks, thus the average time-spent per task is 120 minutes per week. The ratio of least to greatest time spent on any one task is 1 to 9 and the job described has little variance in the time spent on each task. This job could be described as a Preventive Maintenance or "Get Ready" Auto Mechanic.

These five jobs may be considered representative of actual jobs within the broad occupational area of Automobile Mechanic but their composition in terms of tasks performed are clearly specified by the actual time spent on each of the tasks. The subjects were instructed to assume that they were, in fact, performing one of these jobs (each job type being randomly assigned to an experimental group) and use the five different scales provided in an attempt to describe this hypothetical job. The five scales were presented in a completely counterbalanced order within each group to eliminate effects of experience in the later analyses.

Scale A was a five point relative scale with anchors at every point. Scale B was a seven point relative scale with anchors on all points. Scale C was a nine point relative scale, again anchored at each point. Scale D was a twenty five point relative scale with anchorages provided for five intervals on the scale. Scale E consisted of directions to indicate the proportional amount of time spent using direct percentage estimates. Each of these scales, together with the specific instructions, are shown in Appendix B. Each subject thus used five different scales to provide the analyst with the basic occupational information from which an individual job description could be derived. In addition, each subject provided limited biographical information.

Since the actual time spent per week on each task was available, completely accurate percentage values could be easily computed and serve as the criterion against which the derived job descriptions could be evaluated. The rating information supplied by each subject was analyzed using the CODAP system and individual job descriptions for each subject by scale were computed. Those derived values expressed as percent time spent were then compared to the criterion values and the absolute percentage difference across all listed tasks were summated to derive a criterion comparison (CRICOM) value. (As used in this analyses, the CRICOM or error values are equivalent to Euclidean distance.) This experimental measure of error in the job description was used as the dependent variable in a two-way analysis of variance with repeated measures on the scale effect variable. (Winer, 1971, p. 525).

In general, the results and interpretation of this analysis confirmed prior research findings regarding the validity of the time spent scale and suggested that subjects could in fact use more complicated scales with greater accuracy than previously believed. It should be noted that these findings could not be accounted for by any differences in the ability of the groups since the effective randomization of subjects to groups was confirmed in a test of the differences in the mean educational attainment of each group. A one way analysis of variance of the mean educational level attained by each group, which ranged from 11.08 to 12.4 years, showed these differences to be insignificant ($F = 1.70$, $p > .10$). Summary tables reporting the results of the primary analyses are shown in Table 1.

The highly significant main effect of job type on the accuracy of the derived job description was fully expected since the job types were markedly different both in terms of numbers of tasks performed and the distributions of time-spent values. Thus, these findings are of only peripheral interest except to the extent to which they indicate the magnitude of error inherent within the derived job descriptions. The average error per task performed on the derived individual job descriptions range from 2.0% per task for Job Type 2 to .7% per task for Job Type 5. In general, the magnitude of these errors indicate the relative time-spent rating scale to be an effective and accurate methodology for obtaining valid job description data. It is of interest to note that the greatest error occurred in a job which consisted of relatively few tasks and was uniquely distributed in that only one performed task was greater than the mid-range value, whereas ten tasks were of less duration than the mid-range value. Also in this job the actual variance in time spent was high. In comparing the magnitude of these errors with Job Type 3, which included the same number of tasks but with a relatively small variance and an equivalent ratio of tasks above and below the mid-range values (tasks times for this job were in fact normally distributed around the mean) the average error per task performed was found to be .8% per task. Interpretation of these results indicate the accuracy of a derived job description is dependent upon both the number of tasks performed as well as the range and distribution of time spent per task. As the number of tasks is increased, the error per task performed is reduced but there is also an easily demonstrated effect on the accuracy on the derived job description dependent on significant departures from normalacy in the distribution of the task times. However, the generally low values of distortion in the derived job description indicate the derived job descriptions, when based upon a relative time spent scale, to be highly accurate and valid. Thus, the viability of the methodology is clearly demonstrated.

Of primary importance are the significant results related to the effect of scale format on the accuracy of the derived job description. The CRICOM values in this analyses were computed to the nearest tenth percent and the results clearly indicate that the type of scale employed significantly affects the accuracy of the derived job description ($F = 16.12$, $p > .01$). A Newman-Keuls test was performed to locate the specific existing differences in the types of scales. These reults show the five point scale to be significantly inferior to all other scales employed, having significantly larger CRICOM or error values. Additionally, both the 7- and 25-point relative scales are shown to be inferior to a direct estimate of the percent time spent (treated as a relative index value) for each performed task. The 9-point scale was either statistically equivalent or better than all other scales used in study.

Table 1. Data Analyses of CRICOM Values

Job Type	Mean CRICOM (Error) Values Scale A	B	C	D	E	Overall
1	14.49	11.19	10.31	9.71	10.15	11.18
2	32.89	27.07	25.35	24.15	16.69	25.23
3	9.24	9.63	10.21	10.23	10.42	9.95
4	13.86	14.13	13.75	16.96	14.93	14.72
5	14.56	14.47	12.42	14.67	14.49	14.12
Overall	17.01	15.30	14.41	15.14	13.34	15.04

ANOV Summary Table

Source of Variation	SS	df	MS	F
Between Subjects	**62,904.25**	**264**		
A (Job Type)	38,604.43	4	9,651.11	103.30*
Subject's Within Group	24,299.81	260	93.46	
Within Subjects	**39,634.32**	**1,060**		
B (Scale Effect)	19,123.13	4	480.78	16.12*
AB	6,701.45	16	418.84	14.05*
B x Subj's Within Grps	31,009.76	1,040	29.82	

Test on Differences in Means Using Newman-Keuls Procedure

Scale	E	C	D	B	A
Ordered Means	13.34	14.41	15.14	15.30	17.01
E		1.07	1.80*	1.96*	3.67*
C			.74	.89	2.60*
D				.16	1.87*
B					1.71*

Tests for Simple Main Effects

F for Scale Effect at Job 1	6.62*
Scale Effect at Job 2	60.50*
Scale Effect at Job 3	.43
Scale Effect at Job 4	3.14
Scale Effect at Job 5	1.62

Job Type 1 – Test on Differences in Totals Using Newman-Keuls Procedure

Scale	D	E	C	B	A
Ordered Totals	515.21	538.17	546.65	593.04	767.99
D		22.96	31.44	77.83	252.78*
E			8.48	54.87	229.82*
C				46.39	221.34*
B					174.95*

Job Type 2 – Test on Differences in Totals Using Newman-Keuls Procedure

Scale	E	D	C	B	A
Ordered Totals	884.70	1,280.20	1,343.48	1,434.48	1,743.19
E		395.60*	458.84*	549.88*	858.59*
D			63.24	154.28	462.99*
C				91.04	399.75*
B					308.71*

*Significant at $\alpha = .01$.

At this point it should be emphasized that the direct estimates of percent time spent were actually treated as a relative scale value in the derivation of the job descriptions. Direct estimates of actual percentage values were indicated in earlier research (Morsh et al., 1961) to range from a total of 40% summated across all tasks to more than 2000% when summated across all tasks. The same type of findings were obtained in this research with summated direct percent time estimates ranging from 50% to 400%, and only when these percentage estimates are treated as relative values was the accuracy of the derived job description as indicated herein.

Because of the significant interaction between job type and scale format, it can be hypothesized that the accuracy of relative time spent scales is dependent upon the relation between the range of the actual time spent values being evaluated and the maximum capability of the particular type of scale employed to represent these extreme values (e.g., the minimum and maximum percentage values which may be determined by any relative scale is governed by the number of scale points which may be used). An evaluation of the simple main effects was accomplished in order to better analyze this possibility.

Tests for significance of the simple main effects indicated the scale format employed had major impact on the accuracy of the derived job descriptions for two job types employed in this study. Thus, Newman-Kuels for Job Types 1 and 2 were computed. For Job Type 1, the 5-point scale was shown to be significantly inferior to all other scale formats in that the error terms were significantly larger for this scale when compared to all others. For Job Type 2, the 5-point scale was again inferior to all other scales employed, and the direct percentage estimate was superior. For both job types, a general tendency may be observed which indicates that the greater number of scale values available to the respondent results in the generation of more accurate derived job descriptions.

Significant differences were not observed for Job Types 3, 4, or 5, even though the ranges in time spent exactly corresponded to available scales. Thus, it may be surmized that when more scale options are available than required to reflect the range of time spent, a respondent will use only a restricted portion of the scale. In any case, inspection of the mean CRICOM values across all job types suggest the 9-point scale to be generally as accurate as any other scale, regardless of the characteristics of the specific job and only in the case of Job Type 2 is any scale format found to be statistically superior to the 9-point scale.

Since the analyses reported tend to equate a larger number of smaller errors on varied tasks with larger errors on a lesser number of tasks, all analyses were recomputed using CRICOM squared values. This approach obviously minimizes the effect of smaller and less significant errors while maximizing the effect of major deviations in the time spent values on any specific task. Computation of CRICOM squared values for each subject by scale employed were computed using the method previously described with the exception that the differences between the criterion and the derived percentage time spent values at the task level were squared prior to summating across all tasks. Results of this re-analysis are shown in Table 2 and support the original findings in that no major differences were obtained when using the squared values. Thus, the findings regarding the accuracy of the derived time spent values as a function of the scale employed appear to be relatively general in their application and the effects of varying distortion in the distribution of time spent on specific tasks does not greatly affect the validity or generalizibility of the reported results

Although the results reported in this phase of the research were highly consistent, the use of hypothetical job descriptions (as a vehicle for establishing criterion values for evaluating the effects of varied scale formats on the accuracy of the job descriptions) must be considered a second-order estimate of the ultimate criterion. The second phase of the research to be reported employed procedures very similar to the operational job inventory methodology and will be next described.

Research Employing a Job Task Inventory

The stimulus for the second phase of this research was a job task inventory especially constructed to include all tasks performed by Air Force basic military trainees during the six weeks basic training program. This job task inventory was constructed in accordance with the standard inventory construction methodology currently used in the Air Force Occupational Analysis Program. As such, the basic training syllabus and related materials were reviewed and a comprehensive task listing covering each area of basic military training was constructed. The preliminary task listing was then reviewed for clarity and comprehensiveness by training supervisors and instructors from the Basic Military Training Squadrons located at Lackland AFB, Texas. After incorporating all suggestions and information provided by the field

Table 2. Data Analyses Using Squared CRICOM Values

	Mean CRICOM (Error) Values Squared Scale					
Job Type	A	B	C	D	E	Overall
1	40.54	27.09	22.47	22.31	28.16	28.12
2	228.84	171.45	155.95	137.50	77.77	154.30
3	13.53	14.07	16.14	17.00	17.44	15.64
4	18.71	20.23	21.69	39.19	32.42	26.45
5	16.96	20.81	14.50	20.15	32.59	21.00
Overall	63.71	50.73	46.15	47.23	37.68	49.10

ANOV Summary Table

Source of Variation	SS	df	MS	F
Between Subjects	**5,279,948.38**	**264**		
A (Job Type)	3,691,519.06	4	922,879.77	151.10*
Subjects Within Groups	1,588,429.38	260	6,109.34	
Within Subjects	**2,523,691.50**	**1,060**		
B (Scale Effect)	95,119.06	4	23,779.77	13.38*
AB	580,046.81	16	36,252,93	20.40*
B x Subj's Within Grps	1,848,525.69	1,040	1,777.43	

Test on Differences in Means Using Newman-Keuls Procedure

Scale	E	C	D	B	A
Ordered Means	37.68	46.15	47.23	50.73	62.52
E		8.47	9.56	13.05*	24.85*
C			1.08	4.58	16.38*
D				3.50	15.29*
B					11.79*

Tests for Simple Main Effects

F for Scale Effect at Job 1	1.65
Scale Effect at Job 2	89.40*
Scale Effect at Job 3	0.91
Scale Effect at Job 4	2.38
Scale Effect at Job 5	1.44

Job Type 2 – Test on Differences in Totals (Simple Main Effect) Using Newman-Keuls Procedure

Scale	E	D	C	B	A
Ordered Totals	4,121.64	7,287.58	8,265.20	9,086.96	12,128.50
E		3,165.94*	4,143.56*	4,965.32*	8,006.86*
D			977.62	1,799.38	4,840.92*
C				821.76	3,863.30*
B					3,041.54*

*Significant at $\alpha = .01$.

reviewers, a final job task inventory consisting of 150 tasks divided into five duty areas was prepared for administration. In order to make the inventory more realistic, 20 tasks which were known not to be performed in basic training were included for validation purposes. A copy of this basic trainee job task inventory is shown in Appendix C.

Following development of the job inventory, 18 flights of basic trainees were identified as experimental subjects prior to their entry into basic military training. Since the basic training curriculum is highly standarized, it could be assumed that minimal differences between flights would exist in terms of the actual time spent on each of the performed tasks. The technical instructors, who would be with the flights throughout their basic training, were provided copies of the duty task listing and requested to record in minutes throughout each training day, the actual time spent on each performed task by the members of their flight. A mean of the summated time spent on each task throughout the six weeks basic training program could be considered an accurate representation of the total actual time spent, and therefore serve as a criterion against which the accuracy of the derived job descriptions could be evaluated.

The consistency of this criterion information was evaluated using selected subroutines within the CODAP system. One such subroutine, the REXALL program (Stacey, Weissmueller, Barton, & Rogers, 1974), evaluates the inter-rater reliabilities associated with different judges providing ratings on the same information. In addition to the inter-rater reliability coefficient, this program computes the correlation between each rater's evaluation on each element and the mean rating for that element, computing a t-test of differences between each of these ratings across all tasks or elements rated. Insignificant t-values reflect a noncooperative or unconcerned rater in that the pattern of his response is not significantly related to the mean vector. Significant but negative t's have been previously shown to reflect meaningful ratings, but ratings in which the respondent has improperly employed the directionality of the scale. In the REXALL analysis of this data, the time spent values of one of the 18 training instructors was found to be insignificantly correlated with the mean vector and his data was discarded. Although, historically, approximately one of 20 respondents tend to misuse a scale in terms of its directionality, as expected in this application employing absolute values, no negative correlations were obtained. Thus, the ratings of 17 training instructors were used to establish the criterion values for the analyses to be reported. The inter-rater reliability (R_{kk}) of these 17 instructors' specification of the total minutes spent on each of the 130 performed tasks during basic military training was .979 and the reliability for a single rater (R_{11}) was .787 (Lindquist, 1953).

With a stable criterion vector available, the 834 basic trainees assigned to these 18 basic flights served as subjects for this phase of the research. On the next to last day of basic training, each flight was assembled and all individuals provided a copy of the basic trainee task inventory. Eight different scales for possible use in obtaining quantifiable occupational data were used in this phase of the investigation and one specific scale was assigned for use by each individual within the flight. The scales were randomly assigned evenly within flights and are shown in Appendix D.

Scale A is a five-point relative scale anchored at all points and identical to Scale A used in the earlier research. Scale B is a seven point relative scale anchored at all points and identical to Scale B used in the earlier research. Scale C is a nine point relative scale anchored at all points and identical to Scale C used in the earlier research. Scale D is a nine point-relative scale but with only the center (point 5) anchored. Scale E is a 25-point relative scale in which the average (point 13) and the two extremes are anchored with all other values free floating. Scale F consists of directions to estimate the actual percentage of time spent on each task performed to the nearest whole percent. Scale H is a similar direction to estimate the total amount of time in absolute values (hours and minutes spent on each task performed in basic training). Scale G consists of a dual frequency by time formulation in which the subject was requested to select a relative frequency of performance and an absolute time spent per performance. Rating data from this scale format was generated using two techniques. A simple cross product of the frequencies, converted to a 1 through 5 scale, and the time per performance, converted to a 1 through 5 scale, resulted in a 25 point time spent scale. This was treated as a relative scale as were the two preceding scales. In the second technique, used in a *post hoc* analysis, and identified as Scale X, Scale G was recoded in an attempt to derive actual total time spent on each task. Computed values were generated using the following equivalencies. Frequency values of 1 through 5 were recoded as 1, 6, 18, 30, and 75 which represented probable occurrences during the six weeks of basic training. Time values of 1 through 5 were recoded as 2.5, 10, 22.5, 45 and 90, which represented median values in terms of rated time spent per task performance. These recoded values were then cross multiplied resulting in "minute" values ranging from 2.5 to 6750.0.

The job analysis information obtained from each subject was again input for computer analyses using the CODAP programs. Individual percent time spent descriptions were derived and, for each individual, CRICOM values as previously defined were computed. These CRICOM's were then analyzed using a one-way analysis of variance (Winer, 1971) and summarized in Table 3.

Table 3. **Analysis of Variance Individuals vs the Total Group**

Source	SS	df	MS	F
Treatment	16,271.33	7	2,324.48	41.39*
Experimental Error	46,391.06	826	56.16	
Total	62,662.39	833		

Test on Differences in Means Using Newman-Keuls Procedure

Scale	G	B	D	A	E	C	H	F
Ordered Means	129.67	132.79	132.93	133.64	133.73	133.84	142.22	143.09
G		3.12*	3.26*	3.97*	4.07*	4.17*	12.55*	13.42*
B			.14	.85	.94	1.05	9.43*	10.30*
D				.71	.80	.91	9.29*	10.16*
A					.09	.20	8.58*	9.45*
E						.11	8.49*	9.36*
C							8.38*	9.25*
H								.87

*Significant at $\alpha = .01$.

Analyses of this data generally substantiates the interpretations discussed earlier. The significant F value at the .01 level of confidence ($F = 41.39$, $p < .01$) again clearly shows the format of the scale employed in obtaining estimates of the time spent on each task to affect the accuracy of the resulting job description. A Newman-Keuls test to determine the specific locations of the significant differences was accomplished. No difference in the accuracy of the derived job descriptions resulting from the use of scales F and H (direct estimates of percentage time spent on each task and total amount of time spent on each task) was observed, but both of these scale formats, when treated as relative scales, resulted in less accurate derived job descriptions than any other scale employed in the study. On the other hand, Scale G, a frequency times time-spent scale, is statistically superior to all other scales employed. Although the differences identified are statistically significant, it should be noted that the magnitude of the actual average error per task is not markedly different in terms of absolute values. This average error per task ranged from approximately 1.0% per task for Scale G to 1.1% per task for Scale F. These findings indicate that all methodological approaches employing relative time spent scales do, in fact, result in highly valid derived job descriptions.

While this analysis used a highly stable criterion vector determined by 17 raters, actual intercorrelations between each military training instructor and the resulting criterion vector ranged from .72 through .94 with an average correlation of .87 and indicates that some discrepancy in the criterion time spent values existed between each of the flights. The 18 basic flights used in this study were comprised of 9 sets of "sister" flights, each of the two "sister" flights belonging to a single training squadron. Due to the nature of this type of organization, it may be hypothesized that more accurate criterion data could be derived from the mean of the reported total time spent by each of the two "sister" flights. This concept resulted in the establishment of 9 separate criterion values. Correlations between the individual flight criterion values and the mean of their respective squadron criterion values (the mean of two flights) were computed and ranged from .94 to .99. Since these correlations were higher than those between each of the flights in the overall criterion vector, the analyses were recomputed using the squadron criterion data and the results of this reanalysis are shown in Table 4. In this reanalysis the significant effects of scale format ($F = 30.63$, $p < .01$) again indicates the significant effect of scale format on the resultant job validities. The Newman-Keuls procedure now shows Scales A and B to be the more invalid while Scale H (the direct estimate of total time spent) to be significantly better than any other scale employed. It is of particular interest to note than when using the squadron data as the criterion, a clear tendency towards greater validity is observed with the number of scale elements available to the respondent. When using the squadron criterion vector, the average error regardless of the scale employed was less than 1% per task.

Table 4. **Analysis of Variance Individuals vs Their Squadron**

Source	SS	df	MS	F
Treatment	47,677.81	7	6,811.12	30.63*
Experimental Error	183,701.84	826	222.40	
Total	231,379.65	833		

Test on Differences in Means Using Newman-Keuls Procedure

Scale	H	G	F	E	D	C	B	A
Ordered Means	92.99	103.38	104.71	109.38	111.02	113.90	116.38	117.18
H		10.39*	11.72*	16.39*	18.03*	20.91*	23.39*	24.19*
G			1.33	6.00	7.64	10.52*	13.00*	13.80*
F				4.67	6.31	9.19	11.67*	12.47*
E					1.64	4.52	7.00	7.80
D						2.88	5.36	6.16
C							2.48	3.28
B								.80

*Significant at $\alpha = .01$.

Several special analyses were possible as a function of the scale characteristics employed in this study. First, both Scales C and D were 9 point scales differing only in the number of anchorages provided on the scale. In both of the analyses, no significant differences were found as a function of the number of anchorages provided for the respondent on these two 9-point scales. Second, Scale F and Scale G both resulted in a 25-point scale format, although Scale G, in a frequency by times configuration required deriving the cross product to arrive at the 25 point value. While Scale G was superior to Scale E when the criterion vector consisted of the total group means, no significant difference in the accuracy or validity of these two scale formats was observed in the analysis employing the squadron criterion data. Finally, a separate analysis of Scale X, which was previously defined as a derived estimate of the actual time in minutes spent on each task performed throughout basic training, could be compared to the mean job description generated through the use of a frequency by time relative scale (Scale G). A correlated "t" test of differences between the group criterion data and the individual job descriptions, derived from Scale G and expressed as CRICOM values, was computed to compare its accuracy with the calculated individual job description expressed in total minutes as (Scale X). Thus, a direct interpretation of the relative accuracy of an attempted recoding of Scale G, to specify actual time spent on the varied tasks comprising the job, could be accomplished. With respective means of 129.67 for Scale G and 147.28 for Scale X the "t" value of 8.98 was significant at the α .01 level (df = 100). Using squadron criteria resulted in a "t" value of 9.97, df = 100, $p < .01$. Thus, the accuracy of the attempted derivation expressed in absolute minutes spent on each task throughout basic training was found to be significantly less, even though these minute values were treated as another form of a relative scale and the percentage values used in establishing the CRICOM or error values were computed using the INPSTD program. It should be further noted that in its raw format, Scale X could not be construed to represent an actual expression of time spent, since the absolute values summated in most cases to periods of time ranging from less than three weeks to values representing 8 working hours per day for periods in excesses of 6 months.

IV. DISCUSSIONS AND CONCLUSIONS

First, it should be noted that the inaccuracies of direct estimates of percent time spent (or absolute time spent) on those tasks comprising any given job and reported herein were of similar magnitude to those earlier reported by Morsh et al., (1961). However, these serious discrepancies are applicable only when the resultant data is considered to be a direct, absolute estimate of the time spent in performance of the

associated tasks. The hypothesis that these absolute estimates, if treated as relative index values and input into the CODAP programs would result in derived pe.cent time spent values of equivalent accuracy to those derived using relative scales was supported and, when used as a relative index from which percent time spent values were derived, these types of scale formulations had basically equivalent validity for further analyses. However, the accuracy of either absolute time spent values or direct frequency by time-spent computations in no case showed meaningful improvements in accuracy over the relative time spent formulations currently being employed. Thus, the extensive recomputations and recodings necessary prior to input within the CODAP system would appear to be both unnecessary and unprofitable.

With regards to the question concerning the number of categories which people can validly use when estimating the time spent on varying tasks, results of the reported analyses tend to indicate that the previously suggested upper limits may be too conservative. When more scale points than can be easily used are provided, the logical expectation that only selected segments of the scale will be used was found to be fully justifiable. The accuracy of the derived job descriptions did not decline as the relative time spent scales increased in terms of the number of options or responses available to the job incumbent. Basically no difference in accuracy was observed between 9-, 25- or even 100-point relative scales. The same findings, however, were not true with regard to a reduction in the number of scale values available to the incumbent. In all analyses, five points were found to be inferior in terms of derived job validities to the other scale formats investigated. No significant difference was observed between the 7- and 9-point scales; however, since the 9-point scale is of at least equal validity and does, in fact, provide the potential for an increase in validity with no increase in complexity (e.g., both scale formats are encodable in terms of a single digit format), it would appear that the 9-point relative scale provides the optimal format for continued use in the occupational analysis program. Thus, the findings of the research reported herein serve as justification for the recommendation that a 9-point scale be employed in operational administration of the occupational data analysis program for the foreseeable future.

REFERENCES

Archer, W.B. *Computation of group job descriptions from occupational survey data.* PRL-TR-66-12, AD-653 543. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, December 1966.

Archer, W.B., & Fruchter, D.A. *The construction, review, and administration of Air Force job inventories.* PRL-TDR-63-21, AD-426 755. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, August 1963.

Carpenter, J.B. *Sensitivity of group job descriptions to possible inaccuracies in individual job descriptions.* AFHRL-TR-74-6, AD-778 839. Lackland AFB, Tex.: Occupational Research Division, Air Force Human Resources Laboratory, March 1974.

Christal, R.E. *CODAP: Input standard (INPSTD) and variable generation (VARGEN) program.* AFHRL-TR-72-51, AD-750 144. Lackland AFB, Tex.: Personnel Research Division, Air Force Human Resources Laboratory, May 1972.

Christal, R.E. *JAN: A technique for analyzing group judgment.* PRL-TDR-63-3, AD-403 813. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, February 1963.

Christal, R.E., & Ward, J.H., Jr. The MAXOF clustering model. M. Lorr & S.B. Lyerly (Eds.), *Proceedings of the conference on cluster analysis of multivariate data.* New Orleans: Catholic University of America, June 1967, 11.02–11.45.

Lindquist, E.F. *Design and analysis of experiments in psychology and education.* Boston: Houghton Mifflin Co., 1953, 359–361.

Morsh, J.E., & Archer, W.B. *Procedural guide for conducting occupational surveys in the United States Air Force.* PRL-TR-67-11, AD-664 036. Lackland AFB, Tex.: Personnel Research Laboratory, Aerospace Medical Division, September 1967

Morsh, J.E., Madden, J.M., & Christal, R.E. *Job Analysis in the United States Air Force.* WADD-TR-61-113, AD-259 389. Lackland AFB, Tex.: Personnel Research Laboratory, Wright Air Development Division, February 1961.

Stacey, W.D., Weissmuller, J.J., Barton, B.B., & Rogers, C.R. *CODAP: Control card specifications for the Univac 1108.* AFHRL-TR-74-84, AD-A004 085. Lackland AFB, Tex.: Computational Sciences Division, Air Force Human Resources Laboratory, October 1974.

Ward, J.H., Jr. Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association.* 1963, **58**, 236–244.

Winer, B.J. *Statistical principles in experimental design* (2nd ed.). New York: McGraw-Hill, 1971.

APPENDIX A: HYPOTHETICAL JOB DESCRIPTIONS

Ident. Nr._____ (1-3) Scale Used_____ (5-6)

DUTY-TASK LIST FOR JOB TYPE 1 (4)

		X if Done	Actual Time Spent	Time Spent Rating	
DUTY A	MANAGING AND DIRECTING				
Task 1	Establish operational procedures				
2	Establish stock levels for parts				
3	Estimate cost of vehicle repairs				
4	Initiate and complete work orders	X	:20		13-14
5	Maintain vehicle historical records				
6	Supervise mechanics				
DUTY B	INSPECTING AND QUALITY CONTROL				
Task 1	Calibrate test equipment				
2	Evaluate engine operation				
3	Evaluate transmission operation				
4	Perform operational brake inspections				
DUTY C	PERFORMING ROUTINE MAINTENANCE				
Task 1	Change oil and filters				
2	Change tires and balance wheels				
3	Clean and wax autos				
4	Lubricate autos				
5	Perform minor engine tune ups				
6	Replace and adjust headlights				
7	Replace exhaust system components				
8	Service autos with gas and oil				
DUTY D	REPAIRING MECHANICAL SYSTEMS				
Task 1	Align front end				
2	Disassemble engines	X	5:40		45-46
3	Inspect and replace shock absorbers				
4	Inspect or resurface brake drums				
5	Overhaul transmissions	X	7:30		51-52
6	Rebuild engines	X	8:40		53-54
7	Reline brake shoes				
8	Repair and adjust carburators	X	5:00		57-58
9	Repair distributors	X	2:10		59-60
10	Repair master or wheel cylinders				
11	Repair air conditioning systems	X	6:10		63-64
12	Remove and install transmissions				
13	Repair or replace clutch assemblies	X	4:30		67-68
DUTY E	REPAIRING VEHICLE BODIES				
Task 1	Finish painted surfaces				
2	Mix and prepare paints				
3	Paint autos				
4	Prepare auto bodies for painting				
5	Remove and replace damaged glass				
6	Repair or replace auto interior parts				

Ident. Nr._____ (1-3) Scale Used_____ (5-6)

DUTY-TASK LIST FOR JOB TYPE 2 (4)

		X if Done	Actual Time Spent	Time Spent Rating	
DUTY A	MANAGING AND DIRECTING				
Task 1	Establish operational procedures	X	1:20		7-8
2	Establish stock levels for parts				
3	Estimate cost of vehicle repairs	X	2:10		11-12
4	Initiate and complete work orders	X	:50		13-14
5	Maintain vehicle historical records				
6	Supervise mechanics	X	:40		17-18
DUTY B	INSPECTING AND QUALITY CONTROL				
Task 1	Calibrate test equipment				
2	Evaluate engine operation				
3	Evaluate transmission operation				
4	Perform operational brake inspections				
DUTY C	PERFORMING ROUTINE MAINTENANCE				
Task 1	Change oil and filters				
2	Change tires and balance wheels				
3	Clean and wax autos	X	2:30		31-32
4	Lubricate autos				
5	Perform minor engine tune ups				
6	Replace and adjust headlights	X	:50		37-38
7	Replace exhaust system components				
8	Service autos with gas and oil				
DUTY D	REPAIRING MECHANICAL SYSTEMS				
Task 1	Align front end	X	3:20		43-44
2	Disassemble engines				
3	Inspect and replace shock absorbers				
4	Inspect or resurface brake drums				
5	Overhaul transmissions				
6	Rebuild engines				
7	Reline brake shoes				
8	Repair and adjust carburators				
9	Repair distributors				
10	Repair master or wheel cylinders				
11	Repair air conditioning systems				
12	Remove and install transmissions				
13	Repair or replace clutch assemblies				
DUTY E	REPAIRING VEHICLE BODIES				
Task 1	Finish painted surfaces	X	6:20		69-70
2	Mix and prepare paints	X	1:30		71-72
3	Paint autos	X	4:30		73-74
4	Prepare auto bodies for painting	X	12:00		75-76
5	Remove and replace damaged glass				
6	Repair or replace auto interior parts	X	4:00		79-80

Ident. Nr._____ (1-3) Scale Used_____ (5-6)

DUTY-TASK LIST FOR JOB TYPE 3 (4)

		X if Done	Actual Time Spent	Time Spent Rating	
DUTY A	MANAGING AND DIRECTING				
Task 1	Establish operational procedures	X	3:20		7-8
2	Establish stock levels for parts	X	:50		9-10
3	Estimate cost of vehicle repairs	X	4:30		11-12
4	Initiate and complete work orders	X	3:10		13-14
5	Maintain vehicle historical records	X	1:10		15-16
6	Supervise mechanics	X	5:20		17-18
DUTY B	INSPECTING AND QUALITY CONTROL				
Task 1	Calibrate test equipment	X	4:10		19-20
2	Evaluate engine operation	X	3:40		21-22
3	Evaluate transmission operation	X	2:40		23-24
4	Perform operational brake inspections	X	2:00		25-26
DUTY C	PERFORMING ROUTINE MAINTENANCE				
Task 1	Change oil and filters				
2	Change tires and balance wheels				
3	Clean and wax autos				
4	Lubricate autos				
5	Perform minor engine tune ups	X	5:50		35-36
6	Replace and adjust headlights				
7	Replace exhaust system components				
8	Service autos with gas and oil	X	3:20		41-42
DUTY D	REPAIRING MECHANICAL SYSTEMS				
Task 1	Align front end				
2	Disassemble engines				
3	Inspect and replace shock absorbers				
4	Inspect or resurface brake drums				
5	Overhaul transmissions				
6	Rebuild engines				
7	Reline brake shoes				
8	Repair and adjust carburators				
9	Repair distributors				
10	Repair master or wheel cylinders				
11	Repair air conditioning systems				
[illegible]2	Remove and install transmissions				
[illegible]3	Repair or replace clutch assemblies				
DUTY [illegible]	REPAIRING VEHICLE BODIES				
Task 1	Finish painted surfaces				
2	Mix and prepare paints				
3	Paint autos				
4	Prepare auto bodies for painting				
5	Remove and replace damaged glass				
6	Repair or replace auto interior parts				

Ident. Nr._____ (1-3) Scale Used_____ (5-6)

DUTY-TASK LIST FOR JOB TYPE 4 (4)

		X if Done	Actual Time Spent	Time Spent Rating	
DUTY A	MANAGING AND DIRECTING				
Task 1	Establish operational procedures				
2	Establish stock levels for parts				
3	Estimate cost of vehicle repairs				
4	Initiate and complete work orders				
5	Maintain vehicle historical records	X	1:20		15-16
6	Supervise mechanics				
DUTY B	INSPECTING AND QUALITY CONTROL				
Task 1	Calibrate test equipment				
2	Evaluate engine operation	X	2:30		21-22
3	Evaluate transmission operation				
4	Perform operational brake inspections	X	1:10		25-26
DUTY C	PERFORMING ROUTINE MAINTENANCE				
Task 1	Change oil and filters	X	2:00		27-28
2	Change tires and balance wheels	X	1:40		29-30
3	Clean and wax autos				
4	Lubricate autos				
5	Perform minor engine tune ups	X	4:00		35-36
6	Replace and adjust headlights				
7	Replace exhaust system components				
8	Service autos with gas and oil	X	1:55		41-42
DUTY D	REPAIRING MECHANICAL SYSTEMS				
Task 1	Align front end	X	2:20		43-44
2	Disassemble engines				
3	Inspect and replace shock absorbers	X	1:35		47-48
4	Inspect or resurface brake drums	X	4:40		49-50
5	Overhaul transmissions	X	2.50		51-52
6	Rebuild engines	X	5:00		53-54
7	Reline brake shoes				
8	Repair and adjust carburators				
9	Repair distributors	X	1:20		59-60
10	Repair master or wheel cylinders	X	1:00		61-62
11	Repair air conditioning systems				
12	Remove and install transmissions	X	3:40		65-66
13	Repair or replace clutch assemblies				
DUTY E	REPAIRING VEHICLE BODIES				
Task 1	Finish painted surfaces				
2	Mix and prepare paints				
3	Paint autos				
4	Prepare auto bodies for painting				
5	Remove and replace damaged glass	X	3:00		77-78
6	Repair or replace auto interior parts				

Ident. Nr._____ (1-3) Scale Used_____ (5-6)

DUTY-TASK LIST FOR JOB TYPE 5 (4)

		X if Done	Actual Time Spent	Time Spent Rating	
DUTY A	MANAGING AND DIRECTING				
Task 1	Establish operational procedures				
2	Establish stock levels for parts				
3	Estimate cost of vehicle repairs				
4	Initiate and complete work orders	X	:30		13-14
5	Maintain vehicle historical records				
6	Supervise mechanics				
DUTY B	INSPECTING AND QUALITY CONTROL				
Task 1	Calibrate test equipment				
2	Evaluate engine operation				
3	Evaluate transmission operation				
4	Perform operational brake inspections				
DUTY C	PERFORMING ROUTINE MAINTENANCE				
Task 1	Change oil and filters	X	1:40		27-28
2	Change tires and balance wheels	X	2:00		29-30
3	Clean and wax autos	X	3:50		31-32
4	Lubricate autos	X	3:20		33-34
5	Perform minor engine tune ups	X	2:10		35-36
6	Replace and adjust headlights	X	1:00		37-38
7	Replace exhaust system components	X	2:15		39-40
8	Service autos with gas and oil	X	4:30		41-42
DUTY D	REPAIRING MECHANICAL SYSTEMS				
Task 1	Align front end				
2	Disassemble engines	X	2:40		45-46
3	Inspect and replace shock absorbers	X	:35		47-48
4	Inspect or resurface brake drums	X	:40		49-50
5	Overhaul transmissions				
6	Rebuild engines				
7	Reline brake shoes	X	2:30		55-56
8	Repair and adjust carburators				
9	Repair distributors				
10	Repair master or wheel cylinders	X	1:25		61-62
11	Repair air conditioning systems				
12	Remove and install transmissions	X	:50		65-66
13	Repair or replace clutch assemblies	X	:30		67-68
DUTY E	REPAIRING VEHICLE BODIES				
Task 1	Finish painted surfaces	X	3:00		69-70
2	Mix and prepare paints				
3	Paint autos				
4	Prepare auto bodies for painting	X	3:20		75-76
5	Remove and replace damaged glass	X	1:15		77-78
6	Repair or replace auto interior parts	X	2:00		79-80

TIME SPENT SCALE A

Rate the relative amount of time you spend on each task performed in your job, compared with the time you spend on each of the other tasks in your present job. Remember that you are rating only those tasks you perform with each other. Use the 5-point TIME SPENT scale below:

SCALE

1 = very much below average
2 = below average
3 = about average
4 = above average
5 = very much above average

TIME SPENT SCALE B

Rate the relative amount of time you spend on each task performed in your job, compared with the time you spend on each of the other tasks in your present job. Remember that you are rating only those tasks you perform with each other. Use the 7-point TIME SPENT scale below:

SCALE

1 = very much below average
2 = below average
3 = slightly below average
4 = about average
5 = slightly above average
6 = above average
7 = very much above average

TIME SPENT SCALE C

Rate the relative amount of time you spend on each task performed in your job, compared with the time you spend on each of the other tasks in your present job. Remember that you are rating only those tasks you perform with each other. Use the 9-point TIME SPENT scale below:

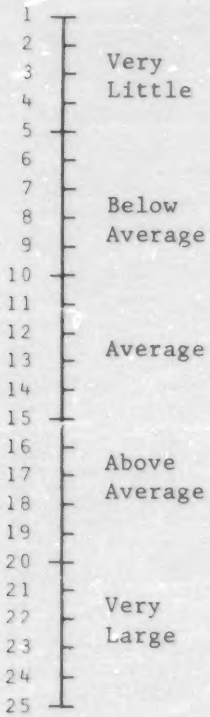
SCALE

1 = very small amount
2 = much below average
3 = below average
4 = slightly below average
5 = about average
6 = slightly above average
7 = above average
8 = much above average
9 = very large amount

TIME SPENT SCALE D

Rate the relative amount of time you spend on each task performed in your job, compared with the time you spend on each of the other tasks in your present job. Remember that you are rating only those tasks you perform with each other. Use the 25-point TIME SPENT scale below:

SCALE



TIME SPENT SCALE E

Rate the proportional amount of time you spend on each task performed in your job, compared with the total time you spend on the job. Remember that you are rating only those tasks you perfrom. Estimate the percent (%) of total work time which you spend on each task that you perform. DO NOT change your estimate once it is made.

APPENDIX C: BASIC TRAINEE JOB-TASK INVENTORY

UNITED STATES AIR FORCE
JOB INVENTORY

JOB-TASK INVENTORY

AFSC 99000

PERSONNEL RESEARCH DIVISION
AIR FORCE HUMAN RESOURCES LABORATORY (AFSC)
LACKLAND AIR FORCE BASE, TEXAS 78236

AFPT 80-99000-107

BACKGROUND INFORMATION

1. CASE CONTROL NUMBER_____ (1:1-4)

2. NAME_____ (5-25)
LAST FIRST MIDDLE

3. SSAN_____ (26-34)

4. Squadron_____ (35-38)

5. Flight Nr_____ (39-42)

6. Date Entered BMT_____ (43-48)

7. Circle the Highest Educational Level (or GED Equivalent) completed (49-50)

Elementary				High School				College				Graduate	
05	06	07	08	09	10	11	12	13	14	15	16	17	18

8. What career ladder (AFS) are you entering?_____ (51-55)

9. Time Spent Rating Scale Used_____ (56)

INSTRUCTIONS

To qualify for this job survey you must be completing basic training. You are to describe your job as an Air Force Basic Military Trainee. Complete this inventory in accordance with the steps shown.

STEP 1. Fill in the BACKGROUND INFORMATION section on page 2. Be sure to indicate the letter identification of the time-spent rating scale you will be using.

STEP 2. Starting with DUTY A on page 3, consider each duty heading and read each task statement under every duty in the inventory. As you read, place a check mark in the CHECK column beside each task you have done in basic training. Check every task you performed regardless of the duty or work area under which it is listed. It is expected that you will have performed most of the tasks listed.

STEP 3. On the blank page at the end of the booklet, write in all tasks you have done which are not listed.

STEP 4. Turn back to DUTY A on page 3 again. You are now to make a TIME SPENT rating for each task you have checked or added. Carefully read the scale instructions and use the time spent scale provided. Be sure to rate every task you checked or wrote in.

STEP 5. Read the directions and answer the questions on the last page of this survey.

STEP 6. Make sure you have completed all task inventory requirements and turn in your booklet as directed.

JOB INVENTORY (DUTY-TASK LIST)	AFSC 99000	PAGE 1 OF 9 PAGES	
DUTY: A. ACCOMPLISH PROCESSING REQUIREMENTS		CHECK (✓) IF DONE	TIME SPENT RATING
1. Attend Commander's incoming briefing			02: 5-8
2. Attend initial moral lectures given by the Chaplain			9-12
3. Complete personal affairs forms			13-16
4. Complete personal last will and testament			17-20
5. Complete required inspection of personal property (shakedown inspection)			21-24
6. Initiate ID cards and photos			25-28
7. Make initial BX visit for purchase of required items			29-32
8. Obtain Geneva Convention card			33-36
9. Obtain initial military clothing issue			37-40
10. Obtain initial military haircut			41-44
11. Obtain initial pay			45-48
12. Obtain PCS orders or assignment to casual flight			49-52
13. Pay for flashlights and locks			53-56
14. Receive dental examination			57-60
15. Receive dental hygiene briefing			61-64
16. Receive ID cards			65-68
17. Receive initial briefing on military law			69-72
18. Receive initial career guidance briefing and counseling			03: 5-8
19. Receive instructions from Military Training Instructor			9-12
20. Receive introductory briefing from Military Training Instructor			13-16
21. Receive issue of gas masks			17-20
22. Receive issue of field jackets, PC clothing and ID necklaces			21-24
23. Receive medical examination and initial immunizations			25-28
24. View career exhibits			29-32

JOB INVENTORY (DUTY-TASK LIST)	AFSC 99000	PAGE 2 OF 9 PAGES	
DUTY: B. PERFORM MISCELLANEOUS TRANSITION DUTIES		CHECK (✓) IF DONE	TIME SPENT RATING
1. Accomplish peer ratings on other flight members			33-36
2. Accomplish physical conditioning by calisthenics			37-40
3. Accomplish physical conditioning by running			41-44
4. Accomplish self study of military subjects			45-48
5. Attend advanced moral lectures			49-52
6. Attend military ball			53-56
7. Clean dormitory (personal area, latrines, halls, etc)			57-60
8. Complete course critiques			61-64
9. Complete test critiques			65-68
10. Determine and obtain needed clothing alterations			69-72
11. Eat scheduled meals in dining hall			04: 5-8
12. Exchange linens			9-12
13. Mark clothing and supplies			13-16
14. Obtain haircuts as scheduled			17-20
15. Participate in air traffic control operations			21-24
16. Participate in fire drills			25-28
17. Perform base support details			29-32
18. Perform mess attendant or KP duty			33-36
19. Perform social visit with TI in his home			37-40
20. Perform student squadron details			41-44
21. Plan graduation exercises			45-48
22. Prepare uniforms for wear (laundry, shoe shining)			49-52
23. Receive final immunizations			53-56
(Continued next page)			

JOB INVENTORY (DUTY-TASK LIST)	AFSC 99000	PAGE 3 OF 9 PAGES	
DUTY: B. PERFORM MISCELLANEOUS TRANSITION DUTIES (CONTINUED)		CHECK (√) IF DONE	TIME SPENT RATING
24. Receive town pass briefing			57-60
25. Serve as subject for experimental testing			61-64
26. Take scheduled breaks during training			65-68
27. Visit BX to obtain personal items			69-72
28. Wait for instructions			05-8
29. Wait in formation			9-12

AFSC FORM JAN 63 1851 PREVIOUS EDITION OF THIS FORM MAY BE USED. GENERAL PURPOSE WORK SHEET (8" X 10½") AFSC-AAFB-WASH.,D.C.

JOB INVENTORY (DUTY-TASK LIST)	AFSC 99000	PAGE 4 OF 9 PAGES	
DUTY: C. RECEIVE FORMAL ACADEMIC CLASSROOM INSTRUCTION IN SUBJECT AREAS LISTED		CHECK (√) IF DONE	TIME SPENT RATING	
1. Accident prevention			13-16
2. Administrative and disciplinary actions resulting from drug abuse			17-20
3. Air Force airman assignment policies			21-24
4. Air Force airman commissioning programs			25-28
5. Air Force communications security (COMSEC)			29-32
6. Air Force history			33-36
7. Air Force mobility concept and force deployment			37-40
8. Air Force OJT (on-the-job training) program			41-44
9. Air Force organizational echelons and chain of command			45-48
10. Air Force quality control program			49-52
11. Artificial respiration techniques			53-56
12. Base pay, allowances, and allotment of military pay			57-60
13. Basic electronic theory			61-64
14. Code of Conduct			65-68
15. Communism and the price of freedom			69-72
16. Driver training			06: 5-8
17. Educational opportunities			9-12
18. Effects of drug use on personal conduct			13-16
19. Equal opportunity and treatment			17-20
20. First aid procedures for shock and injuries			21-24
21. Flying safety requirements			25-28
22. General Air Force security system			29-32
23. General requirements for improved human relations			33-36
(Continued next page)			

AFSC FORM JAN 63 1854 PREVIOUS EDITION OF THIS FORM MAY BE USED. GENERAL PURPOSE WORK SHEET (8" X 10½") AFSC-AAFB WASH.D.C

JOB INVENTORY (DUTY-TASK LIST)	AFSC 99000	PAGE 5 OF 9 PAGES	
DUTY: C. RECEIVE FORMAL ACADEMIC CLASSROOM INSTRUCTIONS IN SUBJECT AREAS LISTED (CONTINUED)		CHECK (√) IF DONE	TIME SPENT RATING
24. Identification of Air Force grade insignia			37–40
25. Identification and function of base level staff referral agencies			41–44
26. Individual's basic rights, freedoms and obligations to the government			45–48
27. Management of individual financial affairs			49–52
28. Mental dangers of drug abuse			53–56
29. Military assistance agencies (AF Aid Society, Red Cross, etc)			57–60
30. Military courtesy to the flag and national anthem			61–64
31. Military leave and passes			65–68
32. Military reporting procedures			69–72
33. Military saluting procedures and situations			07: 5–8
34. Mission of Air Force major air commands			9–12
35. Physical dangers of drug abuse			13–16
36. Prevention of respiratory and fungus diseases			17–20
37. Prevention of venereal diseases			21–24
38. Proper classroom procedures and study habits			25–28
39. Proper wear of the military uniform			29–32
40. Punishment under military law and most commonly violated articles			33–36
41. Race relations			37–40
42. Recognition of and defense against rumors and propaganda			41–44
43. Respect for authority			45–48
44. Summary of academic training			49–52
45. Take academic classroom breaks			53–56

JOB INVENTORY (DUTY-TASK LIST)	AFSC 99000	PAGE 6 OF 9 PAGES

DUTY: D. RECEIVE PRACTICAL INSTRUCTIONS OR FIELD TRAINING IN SUBJECT AREAS LISTED	CHECK (√) IF DONE	TIME SPENT RATING	
1. Accident prevention			57-60
2. Air Force aerobics program			61-64
3. Basic drill commands, positions, and individual drill movements			65-68
4. Basic survival techniques			69-72
5. Bayonet drill			08: 5-8
6. Care and operation of the M-16 rifle			9-12
7. Care and operation of the 45-cal automatic pistol			13-16
8. Care of personal clothing and equipment			17-20
9. Dormitory guard procedures			21-24
10. Field and mess sanitation			25-28
11. Firing range procedures and safety			29-32
12. Flight formations and close order drill			33-36
13. Group living, teamwork, and discipline			37-40
14. Hand-to-hand combat			41-44
15. Identification of Air Force grade insignia			45-48
16. Management of individual financial affairs			49-52
17. Manual of arms			53-56
18. Map reading			57-60
19. Marksmanship training and dry firing M-16 rifle			61-64
20. Methods of transporting injured personnel			65-68
21. Military reporting procedures			69-72
22. Military saluting procedures and situations			09: 5-8
23. Parades and reviews			9-12
(Continued next page)			

JOB INVENTORY (DUTY-TASK LIST)	AFSC 99000	PAGE 7 OF 9 PAGES	
DUTY: D. RECEIVE PRACTICAL INSTRUCTIONS OR FIELD TRAINING IN SUBJECT AREAS LISTED (CONTINUED)		CHECK (√) IF DONE	TIME SPENT RATING	
24. Proper domitory arrangement				13–16
25. Proper wear of the military uniform				17–20
26. Purpose and requirements of confidence course				21–24
27. Respect for authority				25–28
28. Retreat ceremonies				29–32
29. Safety procedures in handling weapons				33–36
30. Squadron and mass formation drill				37–40
31. Summary of academic training				41–44

AFSC FORM JAN 63 1851 PREVIOUS EDITION OF THIS FORM MAY BE USED. GENERAL PURPOSE WORK SHEET (8" X 10½") AFSC-AAFB-WASH.,D.C.

JOB INVENTORY (DUTY-TASK LIST)	AFSC 99000	PAGE 8 OF 9 PAGES

DUTY: E. DEMONSTRATE ACQUIRED KNOWLEDGE AND BEHAVIORS	CHECK (✓) IF DONE	TIME SPENT RATING	
1. Complete performance test in crowd control			45-48
2. Complete performance test in first aid			49-52
3. Complete performance test in group drill movements			53-56
4. Complete performance test in individual drill movements			57-60
5. Complete performance test in physical conditioning			61-64
6. Complete performance test in reporting procedures			65-68
7. Complete performance test in military courtesy and saluting			69-72
8. Complete qualification firing with M-16 rifle			10: 5-8
9. Complete qualification firing with 45-cal automatic pistol			9-12
10. Complete standby clothing fit inspection			13-16
11. Complete written academic proficiency test			17-20
12. Obtain military drivers license			21-24
13. Participate in dormitory inspections			25-28
14. Participate in formal recruiting drives			29-32
15. Participate in parades or reviews			33-36
16. Participate in personal or open ranks inspections			37-40
17. Participate in political rallies			41-44
18. Participate in stand-by inspections			45-48
19. Participate in retreat ceremonies			49-52
20. Perform domitory guard duty			53-56
21. Run the confidence course			57-60

JOB INVENTORY (DUTY-TASK LIST)	AFSC 99000	PAGE 9 OF 9 PAGES

DUTY:	CHECK (√) IF DONE	TIME SPENT RATING	

AFSC FORM JAN 63 1851 PREVIOUS EDITION OF THIS FORM MAY BE USED. GENERAL PURPOSE WORK SHEET (8" X 10½") AFSC-AAFB-WASH.,D.C.

SUMMARY QUESTIONS

Review your time-spent ratings and consider only those tasks you perform and rated as most time consuming and least time consuming. Think of your job as a basic trainee and imagine it to be the same each week. That is, each week all the basic training tasks are performed in the same proportinal amount of time as they are throughout basic training. Now consider any of the tasks you rated as least time consuming. In general, how much time would you spend each week on any one of these tasks? In general, how much time would you spend each week on any one of the most time consuming tasks? In general, how many hours would you work each week?

1. Average total minutes per week spent on any one of the least time consuming tasks performed

   _____minutes per week 1:57-60

2. Average total minutes per week spent on any one of the most time consuming takss performed

   _____minutes per week 1:61-64

3. Average total duty hours per week

   _____hours per week 1:65-68

TIME SPENT SCALE A

Rate the relative amount of time you spent on each task performed in your job, compared with the time you spent on each of the other tasks in your job. Note that you are rating the relative total amount of time spent on each task performed. Therefore, if you performed task A eight (8) times spending 15 minutes each time and performed task B once spending 30 minutes that time, you would probably want to use a larger relative rating for task A than for task B since you are comparing 120 minutes with 30 minutes. Remember that you are rating only those tasks you performed compared with each other. Use the 5-point TIME SPENT scale below:

SCALE

1 = very much below average
2 = below average
3 = about average
4 = above average
5 = very much above average

TIME SPENT SCALE B

Rate the relative amount of time you spent on each task performed in your job, compared with the time you spent on each of the other tasks in your job. Note that you are rating the relative total amount of time spent on each task performed. Therefore, if you performed task A eight (8) times spending 15 minutes each time and performed task B once spending 30 minutes that time, you would probably want to use a larger relative rating for task A than for task B since you are comparing 120 minutes with 30 minutes. Remember that you are rating only those tasks you performed compared with each other. Use the 7-point TIME SPENT scale below:

SCALE

1 = very much below average
2 = below average
3 = slightly below average
4 = about average
5 = slightly above average
6 = above average
7 = very much above average

TIME SPENT SCALE C

Rate the relative amount of time you spent on each task performed in your job, compared with the time you spent on each of the other tasks in your job. Note that you are rating the relative total amount of time spent on each task performed. Therefore, if you performed task A eight (8) times spending 15 minutes each time and performed task B once spending 30 minutes that time, you would probably want to use a larger relative rating for task A than for task B since you are comparing 120 minutes with 30 minutes. Remember that you are rating only those tasks you performed compared with each other. Use the 9-point TIME SPENT scale below:

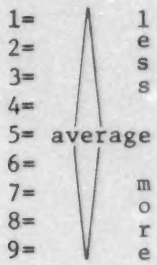
SCALE

1 = very small amount
2 = much below average
3 = below average
4 = slightly below average
5 = about average
6 = slightly above average
7 = above average
8 = much above average
9 = very large amount

TIME SPENT SCALE D

Rate the relative amount of time you spent on each task performed in your job, compared with the time you spent on each of the other tasks in your job. Note that you are rating the relative total amount of time spent on each task performed. Therefore, if you performed task A eight (8) times spending 15 minutes each time and performed task B once spending 30 minutes that time, you would probably want to use a larger relative rating for task A than for task B since you are comparing 120 minutes with 30 minutes. Remember that you are rating only those tasks you performed compared with each other. Use the 9-point TIME SPENT scale below:

SCALE

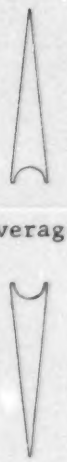


TIME SPENT SCALE E

Rate the relative amount of time you spent on each task performed in your job, compared with the time you spent on each of the other tasks in your job. Note that you are rating the relative total amount of time spent on each task performed. Therefore, if you performed task A eight (8) times spending 15 minutes each time and performed task B once spending 30 minutes that time, you would probably want to use a larger relative rating for task A than for task B since you are comparing 120 minutes with 30 minutes. Remember that you are rating only those tasks you performed compared with each other. Use the 25-point TIME SPENT scale below:

SCALE

1 = almost none
2 =
3 =
4 =
5 =
6 =
7 =
8 =
9 =
10 =
11 =
12 =
13 = average
14 =
15 =
16 =
17 =
18 =
19 =
20 =
21 =
22 =
23 =
24 =
25 = almost all



TIME SPENT SCALE F

Estimate the percentage of your total time in basic military training that you spent on each of the tasks you performed. Make your estimates to the nearest one-tenth (1/10) percent. For example, if you estimate that you spent about two (2) percent of your time in performance of task A-3, record your estimate as 02.0 - if you estimate that you spent about three-tenths (3/10) of one percent on task C-4, record your estimate as 00.3. Remember that you are estimating the total time spent on each task without regard to how often it was done.

TIME SPENT SCALE G

In the left side of the Time Spent column, rate the frequency with which you performed each of the tasks during basic military training. In the right side of the column, rate the amount of time you spent each time you performed that task. That is, you are to indicate how often you performed each task and how long it takes you to perform the task one time. Remember you are rating only those tasks you performed. Use the 5-point Frequency and Time scales shown below and be sure to give both frequency and time-spent estimate for each task performed.

FREQUENCY	TIME
1= once a month or less	1= less than 5 minutes
2= once a week	2= 5 to 15 minutes
3= several times a week	3= 15 to 30 minutes
4= once a day	4= 30 to 60 minutes
5= several times a day	5= more than 60 minutes

TIME SPENT SCALE H

Estimate the total amount of time you spent on each task you performed while in basic military training. Make your estimates as accurate as you can. Record time as 1:30 where number to the left of the colon is hours and number to the right is minutes. For example, if you spent 15 minutes in performance of task A-3, record your estimate as :15. Remember that you are estimating the total time spent on each task you performed without regard to how often it was done.

☆U.S. GOVERNMENT PRINTING OFFICE: 1975 - 671-602/8023